RIA Research and Development Program Outlook

RIA Research and Development Workshop: 8/26-28/2003

R&D Areas	Priority	R&D Items
Beam Simulation	High	Continue the collaborative work to develop end-to-end parallel computing tools for high statistics simulation to optimize the overall system, and to accurately compute beam losses. This R&D is essential to the driver linac
Front end	High	Perform emittance measurements of the source as soon as possible, to feed into linac simulations.
	High	Demonstrate stable CW operation of an RFQ (one segment) over a wide power range (factor of 70) needed when going from p to U.
	Normal	Continue the driver ion source development with an eye toward getting a higher heavy ion current.
Driver Linac	High	Establish performance parameters of strippers, including experiments to measure the scattering and energy loss in stripper materials.
	High	Determine the level of activation and radiation in the second stripper area as soon as possible to see if remote handling is necessary in this area.
	Normal	Bring ongoing cavity development work, including different types of cavities, to a conclusion that is sufficient to provide performance parameters for the end-to-end simulation and ultimately for the choice of the technology.
	Normal	Develop transverse and longitudinal diagnostics for measurement and tuning of high-power ion beams.
	Normal	Study and evaluate driver linac cost saving schemes, e.g., microphonics reduction schemes and Nb sputtered structures.
	Normal	Develop a beam halo detector for the driver linac.
ISOL	High	R&D to optimize targets driven by neutrons from a proton to neutron converter, and verify these results with data obtained from the low-power two-step targets now routinely in operation.
	High	R&D on Resonant Ionization laser ion source and ECR and EBIS charge breeding, which are very promising techniques for ISOL-RIB.
	Normal	R&D to investigate if Hg, instead of molten Li, has advantages as a target and as the target coolant.
	Normal	Develop directly irradiated targets as the interim source of RI beams before the 2-stage source is commissioned.

Fragment		For fragment separators:
	High	• Continue development of fragment separator simulation codes for the collection, separation, and stopping process, and continue the process to verify these codes.
	High	• R&D on beam dumps including: simulations of the beam dump locations; beam power and power densities for various production scenarios; and power requirements of collimator slits and magnet liners for a range of production scenarios and failure modes.
	High	• R&D on high-power fragmentation targets including: stability of windowless liquid lithium at power densities for 1-mm diameter uranium beams at 400MeV/u with minimum powers of 100 kW; and target scenarios for lower Z beams.
	High	• Simulations to characterize radiation doses to magnets and other components near the production targets and beam dumps, and development of appropriate containment for activated coolants such as liquid lithium and water
	High	• Develop magnet design concepts that are consistent with the radiation doses calculated above and the field and aperture requirements set by the optics calculations.
	High	• Develop concepts for remote handling/maintenance that may be required for radiation damaged and activated magnets and other components.
Fragment		For Gas Cell:
	Normal	• Determine by detailed simulations the limitations of the range bunching technique and the optimum energies for range bunching and overall production yields
	Normal	• Study the matching of the separator, gas cell, and post acceleration stages
	Normal	• Study intensity limitations and efficiency of the gas cell, and explore options to increase the efficiency and/or reduce space charge effects in the cell.
	Normal	• Explore alternative gas cell geometries that have promise to increase the overall efficiency of the system and investigate possible alternative catchers for very high intensities or specific ions species.
Post Acc		R&D in the post acceleration LINAC system can have an important impact on the total efficiency of the accelerator. While study of design efficiency and possible alternatives is encouraged, some of the important outstanding issues are:
	High	• Study issues with combined 15-Tesla solenoid and SC resonator unit.
	High	• Study the properties of a high-resolution isobar-separator in terms of tolerances and technical feasibility.
	High	• Develop beam position monitor for very low intensity secondary RI beam.

	Normal	• Prototype hybrid RFQ, and test with full range of rf power, and with beam for q/A=1/132.
	Normal	• Prototype SC resonators to demonstrate E_{peak}=20 MV/m.
	Normal	• Study beam dynamics options for focusing low q/A heavy-ion beams.
	Normal	• Develop high precision beam energy measurement system for secondary beams.
Multi User	High	Investigate and incorporate a capability that permits and enhances realistic simultaneous independent RIB experiments.
	High	Conceptual study of beam splitting with variable intensity on several targets for effective multi-user operation; develop equipment to support this scheme.
Facility	High	Study of the nuclear facility aspect of parts of the RIA facility.
	High	A realistic overall concept of the accelerator facility design is urgently required, since the concept will impact R&D requirements for conventional facility, remote handling, radiation safety, and nuclear facility consideration.
	High	Develop an algorithm to assess the overall reliability and availability of the facility, based on mean-time between failure and mean-time for repair models, and evaluate engineering options to include redundancy and to reduce unscheduled shutdowns.